THE FUNCTIONS OF A GREAT UNIVERSITY.

With Compliments of

F. M. Clark

THE FUNCTIONS OF A GREAT UNIVERSITY

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BY

J. M. CLARK, M.A., LL.B.

President of The University College Literary and Scientific Society.

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Mr. Chairman, Members of the Literary and Scientific Society, Ladies and Gentlemen:

Allow me first, Mr. Chairman, to express to the members of the Literary and Scientific Society my sincere appreciation of the great honor they have conferred upon me in unanimously electing me to the presidency of their Society. When one glances over the long list of illustrious ex-presidents, including, as it does, such able statesmen as the late Adam Crooks, for many years Minister of Education; such brilliant jurists as the Honorable J. A. Boyd, Chancellor of Ontario and Chairman of Convocation; such noted publicists as Mr. Thomas Hodgins; such eminent educationists as the respected President of the University of Toronto, the late head of the Ontario Law School, and our distinguished chairman, one must undertake the responsibilities of such a position with hesitation and trepidation. This is especially the case when one remembers the highly important functions which this Society performs, and is calculated to perform, in this University and in the intellectual and social life of the student body.

The objects of the Society are, by its much-discussed constitution, defined to be: "(*a*) The encouragement of literary and scientific pursuits and public speaking; (*b*) The encouragement of such affairs and the discussion of such

questions as properly come within the province of the student body of the University of Toronto."

The mere statement of these objects will suffice to indicate the important part played in student life by the Literary and Scientific Society, and it may safely be said that the student who neglects the work of this Society makes a serious mistake. The mistake made by that student who takes no part in the work of the Literary and Scientific Society is a serious one, not only from his own standpoint, but also from a university and college standpoint. He loses a most interesting means of improvement (shall I add of recreation?), and invaluable opportunities of becoming acquainted with his brother students; for the friendships formed in the Literary Society, and in connection with its work, are often the closest and most enduring we make, and furnish us with the most pleasant memories of undergraduate days. The University also loses by any neglect of the Literary and Scientific Society, for it is certainly one of the most effective means of developing and maintaining that proper *esprit de corps* which may truly be said to be essential to the permanent prosperity of our College and University.

It is a great relief to be associated with active and energetic officers, to have the assistance of a vigilant and efficient committee, and to know that I can count on the constant co-operation of every member of the Society.

There are a great many questions which might usefully engage our attention on an occasion such as the present; for instance, it would be fitting to discuss the present status of the University of Toronto and of University College, and the relation of these institutions, to each other, to the State, and to the educational system of the Province.

As you are all aware, the University of Toronto was originally designed to imitate, as far as the circumstances would permit, the great historic universities of Oxford and Cambridge; but in 1849 and 1853 it was reorganised, and

the model of the then recently established University of London was largely followed in this reorganisation.

The London system, of a teaching college and an examining university, was continued till seven years ago, when the unique experiment of a university federation was attempted. The results of this experiment remain for the future to disclose. We will hope that the many difficulties in the way of permanent success will be removed, and the obstacles to progress and development overcome; but to accomplish this result will tax to the utmost the resources of our college and university statesmen, and will require the most strenuous and united efforts of all the friends of the University of Toronto, and especially of all the friends of University College.

At the present time this is a State University, but only recently the Province declined, in the most emphatic way, to be responsible for its proper support and adequate equipment, and intimated that it is hopeless to expect the Provincial Legislature to provide the funds which are admittedly necessary to enable the Provincial University efficiently to discharge the exalted, nay, vital duties which she exists to perform. The friends, however, of our State University will rejoice at the generous recognition of the just claims of the Provincial University upon the resources of the Province so eloquently expressed by the Hon. G. W. Ross, the Minister of Education, at our last Commencement.

We are not likely to have in our Provincial Legislature any considerable number of members like the representative who, in one of the Western State Legislatures, opposed a proposed grant to a college library, and distinguished himself by asking whether the librarian had read all the books then in the library.

The University is, by reason of its connection with the State, unquestionably deprived of the gifts of private munificence which so magnificently contributes to the endowment of other universities, such as Queen's, McGill and

the great American universities. We all rejoice at the princely gifts to McGill of such men as W. C. Macdonald, the Molsons, the Redpaths, and Sir Donald Smith, who together have contributed over two million dollars to the endowment of various departments of learning and research, and hope that their liberality may stimulate the wealthy men of Toronto and Ontario to follow the commendable example set them by those gentlemen of Montreal.

The question of whether the present relations of the University of Toronto and University College to the Province should not be severed, or, at any rate, materially modified, is a serious, and, I may add, a pressing one. The complicated and indeed crude nature of the arrangements now subsisting between the various governing bodies of the University and College can scarcely be regarded as permanent.

It would be difficult to give an accurate description of these peculiar arrangements—indeed, it would be difficult to describe our University constitution, except by saying that it is neither flesh, fowl, nor good red herring.

With these interesting and important questions of University politics, I do not propose on the present occasion to deal; rather, I shall in briefest fashion give expression to a few thoughts on the true functions of a great University, although time will not permit me to deal with all the important functions which a great University must necessarily perform, nor even to deal exhaustively with any of them.

The duties of teaching and examining, while so urgently necessary, are so obvious and well recognised that it is not necessary to delay to discuss them.

It is the duty of the University not only to impart to her students the body of truth already known, but also to implant and foster in them a love of truth for its own sake; for she can bestow on her sons no greater blessing than the awakening of a true love of science or literature. Neither can satisfy the deepest needs or the highest aspirations

of our natures, nor assuage our keenest griefs, but either can enrich and ennoble one's life. To him who truly loves either Science or Literature, who delights to behold "the bright countenance of truth," life may not become "weary, stale, flat, and unprofitable," for of either it may be truly said that age cannot wither her, nor custom stale her infinite variety.

In considering what are the true functions of a University, it is well to bear in mind that (to adapt the saying of Goethe) the important thing is not what the student can accomplish, but what may be accomplished in him. A man may be "deep versed in books, yet shallow in himself." Probably many students may truly, sadly sing (with variations):

> I have now, alas, Philosophy,
> Medicine and Jurisprudence, too,
> And, to my cost, Theology,
> With ardent labor studied through.

And yet it may be said:

> And there he stands with all his lore,
> Poor fool, no wiser than before.

However highly we regard the privileges and advantages of a University education, it may as well be candidly admitted that there are many graduates who derive and have derived no benefit whatever from their University course; that, however, is their fault and misfortune, and in no sense can be regarded as the fault of the University. It is necessary to remember the old proverb, that "an ass by travelling does not become a horse." Such a graduate, however, is the exception that proves the rule.

In the great majority of cases, a University training is of the greatest possible benefit, making its recipients more useful and energetic, imparting to them not only useful knowledge and information, but also education and culture. It creates high ideals and helps toward their realisation, for the true student is likely to ponder on Ruskin's noble words, "Mighty of heart—mighty of mind. Magnanimous—to be this is indeed to be great; to become this increasingly

is indeed to advance in life—in life itself, not in the trappings of it."

But I desire to emphasise the duty of this as of every other great University, not only to train students for usefulness, but also to promote original research, and to provide effective means for the advancement of learning, and the extension of scientific knowledge.

Quite as truly now as in the days of Newton, it may be said that the ocean of truth lies all undiscovered before us. Surely, then, it is a vital function of a true University not only to teach and train students, to implant in them a love of truth for its own sake, but also to search out new truth and to enlarge the boundaries of human knowledge. To adapt a familiar quotation, we may say that to the great Universities truth "entrusts the ark of her awful and magnificent cause"; it therefore behooves the University of Toronto to see to it that the sacred trust is not betrayed.

There would not be time to indicate or even to suggest the fields of research which are open and unexplored, inviting investigation—all promising rich rewards. Nature has yet many precious secrets to reveal to the earnest searcher after truth, who makes "industry his oracle and reason his Apollo." As was well said by Lord Rayleigh, "The work may be hard, the discipline severe, but the interest never fails, and great is the privilege of achievement."

Take even the subject of Mathematics, which many regard as a perfectly developed and fixed science. It is not necessary to say that such an idea is quite erroneous. Many of the departments of even pure mathematics are yet in their infancy. Even geometry, one of the oldest of the sciences and one of the richest with the spoils of time, is yet capable of almost indefinite development, and our accomplished Chairman now teaches to those who have manifested their appreciation of the "hard-grained beauties of the cube and square" the modern geometry in which

the axioms and postulates of Euclid are not recognized—indeed, have no place.

Notwithstanding the immense advances of recent years, the most pressing necessity of mathematics and science is a more powerful calculus. Many of the processes of nature are so subtle and complicated that the resources of the present calculus are utterly incapable of grappling with them. Here, then, there is great need for the work of another Leibnitz, another Euler, another Bernouilli, another Wallis, another Lagrange, Cayley, or Sylvester, and who shall say that he shall not be produced by University College?

To prove the significance of this, it is sufficient for me to quote Lord Kelvin, who testified that he perceived many of his important discoveries lurking in his equations before he detected them in his experiments.

Astronomy, perhaps the grandest and most fascinating of the sciences, one which has occupied the attention of many of the noblest minds of the past, and is occupying the attention of many of the keenest intellects of the present, yet still offers unbounded scope for the untiring labors of future generations. The unflagging industry of Kepler and the genius of Newton made known many of the laws governing the solar system; and the history of the discovery of the new planet, by Dr. Adams, indicates the advanced stage reached by astronomical science; yet we hear of the New Astronomy, and it would be vain to deny that treasures as rich as any yet found are waiting to reward the patient and bold explorer.

In 1842 Comte, in his "Cours de Philosophie Positive," said in reference to the possibilities of knowledge of the heavenly bodies: "We can conceive the possibility of determining their forms, their distances, their size and their movements, yet we can never, by any means, study their chemical composition or mineralogical structure." Yet seven years previously, Wheatson had pointed out to the British Association for the Advancement of Science the possibilities

of Spectrum Analysis and the method thus furnished of analysing bodies, the light from which could be obtained ; and twenty-two years after, it was determined by this method that the unresolved nebulæ were enormous masses of luminous gas or vapor. The history of the spectroscope, one of the most delightful of the fairy tales of science, is a striking commentary upon the words of the philosopher, and suggest the folly of attempting to limit the possibilities of the advance of science. All things are possible to him who perseveres.

The utter inadequacy of the appliances of our Provincial University for teaching this great subject, to say nothing of the entire absence of any means of pursuing original investigation, is simply deplorable. Here, then, is an unrivalled opportunity for one of our wealthy men to write his name indelibly upon the fair page of our University history, and to link his fame with the noblest of the Sciences.

What we have said of pure mathematics applies with greater force to Physics. Great as has been the progress of the past one hundred years, there is every reason to expect greater, much greater, progress in the coming century.

Many problems in Acoustics remain unsolved, and many of its most interesting phenomena remain unexplained. For instance, no complete scientific explanation of the action of the telephone, an instrument of great scientific as well as practical importance, has yet been given.

Optics still offers a field for original research sufficiently magnificent and promising to satisfy the most ambitious.

Notwithstanding the work of Rumford, Joule, Clausius, and Maxwell, the theory of heat is yet incomplete.

Above all do the intensely interesting subjects of Electricity and Magnetism offer splendid opportunities for discovery. Not only is the successful study of these subjects of immense importance from a purely scientific point of view, but it is in this direction that we may look for the most useful inventions of the future. In this connection,

Bacon's maxim, that knowledge is power, has proved, and will prove, most emphatically true.

Without discussing the merits of the Aqueduct scheme, or its demerits (which would be a more fruitful theme), we may say that Canada, and particularly Ontario, has so many water-powers of practically unlimited capacity for doing work that to Canadians this subject is one of prime national importance, as there can be little doubt that in the near future many of these sources of energy, now vainly offered us by nature, will be rendered commercially available.

Perhaps the most magnificent achievement of modern science has been the establishment of the law of the conservation of energy; that is, that all the so-called natural forces—heat, light, chemical affinity, electricity, magnetism, etc.—are simply manifestations of an unchangeable amount of indestructible energy. According to this principle, every form of energy is capable of being transformed by suitable manipulations into all its other forms, without in any case involving any increase or diminution of the total quantity of energy. But whilst the quantity of energy in the universe is invariable, yet by virtue of laws which it is unnecessary here either to state or discuss, the amount of what may be termed available energy is being constantly exhausted; in other words, as was first clearly pointed out by Sir William Thomson, now Lord Kelvin, there is a universal tendency in nature to the "dissipation" of mechanical energy.

The theoretical foundation of the modern doctrine of the conservation of energy was clearly and distinctly laid by Newton, but no further advance of any consequence was made until about one hundred years later, when the experiments of Davey and Rumford established the immateriality of heat.

The calculations and conclusions of Fournier and Carnot were expressed, it is true, in terms which, to a certain extent, involved the now exploded corpuscular theories of heat and light, but their reasonings and results were to

such an extent independent of any particular theory that the elements involving the truths of these untenable hypotheses are capable of being almost entirely eliminated, leaving results which have proved of the greatest use in the development of the true theory of energy.

Joule, the great English physicist, by means of some of the most ingenious experiments of modern times, placed the grand law of the conservation of energy on a true experimental foundation. His results were extended by Helmholtz, Mayer, Clausius, and Thomson, till the law of conservation has been shown to govern all natural forces.

Thomson demonstrated that Faraday's discovery of the rotation of the plane of polarisation of a polarised ray of light produced by media under the influence of a powerful magnet, or, in other words, the "magnetisation of light,"—which Tyndall likens "to the Weisshorn among the mountains, as high, beautiful, and alone,"—involves the dependence of magnetism on motion, or, more correctly, on energy.

The principles of the conservation and transformation of energy were shown to govern physiological phenomena by Carpenter, and by Helmholtz, the great professor of the University of Berlin, whose death a few weeks ago is one of the severest losses science has sustained for many years.

While in the manner above roughly sketched the truth of the principles mentioned has been established, yet their far-reaching consequences have not been determined, and much yet remains to be done before a true theory of energy is completely developed and established. It would be futile to attempt to define the lines along which such development is destined to take place; it is sufficient for my present purpose to point out the possibilities, nay, the certainty, of such development, and its momentous consequences.

In the prevailing physical theories, the mysterious ether supposed to be necessary for the propagation of light plays

an important part, and it is manifest that this part will, in the Physics of the future, be increasingly important. Many deny its very existence, and assert that it is a phantasy of the mathematical imagination; yet the greatest of living physicists says (in his lectures on Molecular Dynamics) that "we know the luminiferous ether better than we know any other kind of matter in some particulars." However, the properties of this mysterious ether which pervades not only interstellar, but intermolecular and interatomic space remain largely unknown, and Tyndall has predicted that the Physics of the future will be mainly occupied in their investigation.

The ultimate nature of matter is yet to be determined. Since the atomic theory as developed by the Greek philosophers was expounded by Lucretius, various hypotheses have been suggested to explain matter and account for its properties; such, for instance, as the fantastical theory of Boscovitch, who discarded "atoms" and "molecules," and substituted centres of force which were geometrical points, that is, without length, breadth, or thickness; or the more scientific vortex-atom theory of Sir William Thomson. While Thomson's exceedingly interesting theory has certainly fulfilled, and will to a greater extent fulfil, the recognized functions of a scientific hypothesis, it remains to be seen whether the correct explanation has yet been given.

We have not time here even to outline the possibilities of progress in the various departments of what we call Natural Science. Great as we esteem the triumphs of the past, they are but a feeble indication of what is in store for future scientists. Indeed, the scientist who has the most profound insight into the mysteries of nature will be the most ready to acknowledge, in the language of Tennyson, that he is but

> An infant crying in the night,
> An infant crying for the light,
> And with no language but a cry.

Sometimes it is said to be dangerous to pursue scientific research, and it is objected that such pursuit of science tends

to scepticism, or, rather, to materialism or "naturalism.' Francis Bacon's saying that a little philosophy inclineth a man's mind to atheism is, perhaps, true of science, but as in philosophy so in science, the remedy is a more profound knowledge and deeper study. "Freedom alone can cure the errors of freedom, and a riper knowledge the errors of what is unripe."

At the same time, it is necessary to bear in mind the truth of what was so well expressed by Rayleigh in his address to the British Association for the Advancement of Science at the Montreal meeting: "In his heart he [the scientific worker] knows that underneath the theories which he constructs there lie contradictions which he cannot reconcile; the higher mysteries of being, if penetrable at all by the human intelligence, require other weapons than those of experiment and calculation."

Indeed, to adapt the words of Chalmers, the greater the circle of light the greater the circumference of darkness which surrounds this circle, growing more mysterious and tremendous as the circumference is increased. The great mysteries of being will persistently hover round this illuminated circle, or (to use the modification of the metaphor by Professors Stewart and Tait) "this illuminated sphere of scientific thought, of which duration, extension, and structural complexity may be regarded as the three independent co-ordinates in terms of each of which the process of development goes on simultaneously as the boundary of the sphere is enlarged."

An equally strong case could be made out (did time and occasion permit) for the other departments of knowledge and science.

In the great subject of Sociology there is ample scope for the most ambitious. Like most other departments of science, it is a department of unsolved problems. Even a superficial survey of the state of society cannot fail to convince the most optimistic that the evils of national,

political, social and industrial conditions are, to use the apt words of Browning,

"Multiform, manifold, and menacing."

The demand for remedies for these evils is one of imperative urgency. Statecraft must call science to its aid, for such evils can only be cured by the removal of their causes.

In connection with our subject, it is not merely fitting but just, that brief reference be made to some of the work achieved by members of the University of Toronto.

The name of the late revered and loved Professor of Philosophy, George Paxton Young, suggests itself to every mind. Though the solution of equations has occupied the attention of men like Newton, Descartes, Fourier, Sturm, Lagrange, Sir W. R. Hamilton, Cayley and Sylvester, Professor Young succeeded in making a very distinct and valuable addition to our knowledge of the subject. By the penetrating subtlety of his keen analysis and the persistent power of his irresistible perseverance, Professor Young discovered and proved a remarkable and beautiful law of great simplicity, governing the relations between the roots of rational irreducible equations of the higher degrees.

Equally brilliant have been the discoveries of Professor Young in regard to the solution of quintic equations. He has ended the debate as to the possibility of the algebraic solution of equations of the fifth degree by determining a criterion of their solvability, and by effecting the solution of all quintic equations which satisfy the criterion.

We will love and cherish the name and memory of George Paxton Young as that of a great and good man, a true and faithful friend, a prince among teachers, an acute metaphysician, but other countries and posterity will know and honor him as a great mathematician.

There is not time now even to mention such excellent works as those of Professor Campbell, whom certain ecclesiastics accused of losing his way in pursuing the Hittites;

and that of Doctor McCurdy, the scholarly Professor of Oriental Languages.

In this connection, I may also refer to the valuable work of President Loudon in applying geometrical methods to the discussion of the theory of thick lenses. Those of you who have mastered, or attempted to master, the intricate algebraical investigations of the subject as given, for instance, in the English text-books on optics will appreciate what Professor Loudon has done.

Mention must also be made of such work as that done in Ethnology and Philology, by Dr. A. F. Chamberlain; in Political Science, by J. M. McEvoy, the author of an important monograph on "The Township;" by Dr. Maclean (who has left us to become Professor of Economics in the University of Colorado) on Finance; by Dr. Tracy, the author of the "Psychology of Childhood"; by Mr. McGee, in Orientals; and by Dr. Miller in Chemistry.

These contributions are not only valuable in themselves, and for their intrinsic merit, but also as suggestive of marked ability and real power, and as manifesting the true scientific spirit, and as giving bright promise of important work in the future.

The researches, especially in Morphology, of Prof. Ramsay Wright have, it is said, produced results of considerable value, and his contributions to scientific journals have brought great credit upon the University of Toronto. His praiseworthy attempt to introduce post-graduate work in this University is deserving of success, and will in the future bear good fruit, for really we should look forward to the establishment of post-graduate courses in as many departments as the resources of the University will permit.

Prof. Wright has delivered to University graduates a very valuable series of lectures, which were much appreciated by those who had the privilege of listening to them. His pioneer work in this direction has done much to create

and stimulate the true scientific spirit, and to encourage and promote original research and investigation.

The researches as to the origin of the blood pigment, and the relation of iron to the animal and vegetable cell, of Dr. A. B. Macallum, have already been productive of most important results. Some five years ago he discovered micro-chemical methods by means of which he demonstrated the presence of iron in chromatin. Dr. Macallum's paper published in the proceedings of the Royal Society in 1891 has marked an epoch in the history of the subject. These results have been followed up by valuable papers published in various scientific periodicals, indicating great research and originality. Dr. Macallum has proved that iron is a constant constituent of the fundamental life substance in every cell, a fact not previously even suspected.

It is to be hoped that Prof. Macallum will continue his researches, and that his brilliant successes, which have shed lustre upon the University of Toronto, may be repeated, and that he may succeed in solving the allied problems, upon the solution of which, by means of micro-chemical methods discovered by himself, it is understood he is engaged.*

Not only in the history of the individual members of this Society, but also in the history of this country, the foundations are now being laid. To both it is of the utmost consequence that this Provincial University should efficiently discharge her true functions.

In this beloved Canada of ours we have the "promise and potency" of a great nation. If our University and College perform faithfully their true functions, that promise will

*Since the above address was delivered an account of a paper by Dr. Macallum "On the Distribution of Assimilated Iron Compounds other than Hæmoglobin and Hæmatins in Animal and Vegetable Cells" has appeared in Vol. 57 of the Proceedings of the Royal Society.

be fulfilled, and possibilities more glorious than we now dream of will be realised.

As "Fidelis" well says, "As yet the waxen mould is soft, the opening page is fair." Let our University see that there is impressed "the stamp of true nobility, high honor, stainless truth," and that her sons are inspired by:

> The earnest quest of noble ends, the generous heart of youth,
> The love of country soaring far above dull party strife,
> The love of learning, art, and song, the crowning grace of life;
> The love of Science soaring far through nature's hidden ways,
> The love and fear of nature's God, a nation's highest praise.

Then we can say with well-founded confidence:

> So in the long hereafter this Canada shall be
> The worthy heir of British power and British liberty.
> Spreading the blessings of her sway to her remotest bounds,
> While with the fame of her fair name a continent resounds.
> True to her high traditions, to Britain's ancient glory,
> Of patient saint and martyr, alive in deathless story;
> Strong in their liberty and truth to shed from shore to shore
> A light among the nations till nations are no more.